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REMARKS

Claims 1-23 are pending in this Application. Claim 1 has been amended to recite that the second portion of the diffusion barrier is deposited after deposition of the first portion of the diffusion barrier. Support for the amendment is found throughout the specification, including in Figures 1A, 2B and 2C and the associated discussion on pages 12-15.

Applicants gratefully acknowledge withdrawal of the rejections over Hashim. All pending claims are currently rejected over U.S. Patent No. 6,274,008 to Gopalraja et al. ("Gopalraja"). Applicants respectfully request reconsideration in light of this amendment and the following remarks.

Rejections Under 35 U.S.C §§ 102 and 103

Claims 1-2, 6-18, 16-19, 21 and 22 are rejected under 35 U.S.C 102(e) as being anticipated by Gopalraja.

Claim 1 relates to a method for depositing a diffusion barrier and metal conductive layer involving depositing first and second portions of a diffusion barrier, and then depositing a metal conductive layer. The claim recites, in part, the operations of (a) etching the bottoms of recessed features to clean at least part of an underlying metal while simultaneously depositing a first portion of a diffusion barrier on at least sidewalls of recessed features; and (b) after depositing the first portion of the diffusion barrier, depositing a second portion of the diffusion barrier, which covers at least the bottoms of the recessed features.

Gopalraja describes a method of filling vias that involves three metallization steps: 1) a first step of highly ionized sputter deposition of copper, 2) a second step of lower-energy sputter deposition of copper to complete the copper seed layer, and 3) and electroplating copper into the hole to complete the metallization (abstract and Figure 16). In the embodiment depicted in Figures 14 and 15, Gopalraja shows forming a diffusion barrier layer (218) prior to the copper sputter depositions steps, which form a copper seed layer (226 and 228) on the sidewalls 222 and top of the dielectric. This process is also depicted in the flowsheet in Figure 16.

There are two steps in Gopalraja that relate to deposition of a diffusion barrier:

- Conformal deposition of the diffusion barrier (218) in via 216 on top of the dielectric 216. Step 232 in Figure 16.
- High energy sputter deposition of copper, that cleans the bottom of the via hole and coats its sidewalls. Step 234 of Figure 16.

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It is the Examiner's position that the high energy sputter deposition of copper, which etches through the bottom of the diffusion layer and redeposits it on the sidewall, meets Applicants' operation (b). (Advisory Action).

Applicants acknowledge that both the barrier layer and the copper are resputtered in the high energy sputter, as pointed out by the Examiner in the Advisory Action. However Applicants respectfully submit that there is no teaching or suggestion in Golparaja that high energy deposition results in forming a portion of the diffusion barrier that covers "at least the bottoms of the recessed features," as required by claim 1. Rather, Golparaja discloses that the high energy sputter removes material from the bottom of the feature, in some cases enough to provide direct contact between the seed layer and the underlying metal. (col. 5, lines 10-16; col. 13, lines 25-27). See also FIG. 15 of Golparaja, which shows the barrier layer is removed at the bottom of the via.

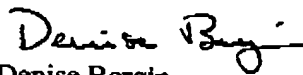
In view of the above, it is respectfully submitted that claim 1, and all of its dependent claims, are not anticipated by Golparaja.

Claims 3-5, 9-15, 20 and 23 are rejected under 35 U.S.C 103(a) as being unpatentable over Golparaja. Applicants submit that there is no teaching or suggestion of recited elements of operations (b) of claim 1, as discussed above with respect to the 35 U.S.C § 102 rejection.

Conclusion:

In light of the foregoing amendments and remarks, Applicants respectfully submit that all pending claims are now in condition for allowance. Thus, Applicants respectfully request a Notice of Allowance from the Examiner. Should any unresolved issues remain, the Examiner is encouraged to contact the undersigned at the telephone number provided below. No fees appear to be necessary for this Amendment. However, if the Commissioner determines that any fee is due, such fee may be charged to deposit account No. 500388 (Order No. NOVLP024X2).

Respectfully submitted,
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